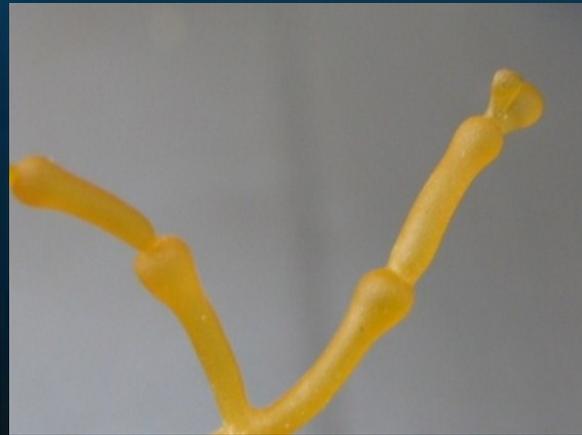


# Outplanting of cultured native urchins (*Tripneustes gratilla*) as a restoration tool for coral reefs

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*Hawaii Division of Aquatic Resources*  
November 2, 2012

# Main Species of Interest

- *Gracilaria salicornia*



- *Kappaphycus / Eucheuma*  
~3 known species

- *Kappaphycus* spp. (clade A)
- *Kappaphycus* spp. (clade B)
- *E. denticulatum*
- Exhibit morphological plasticity



# Kaneohe Bay 2009, Oahu



## Kappaphycus/Eucheuma spp.

□ (Not Present)

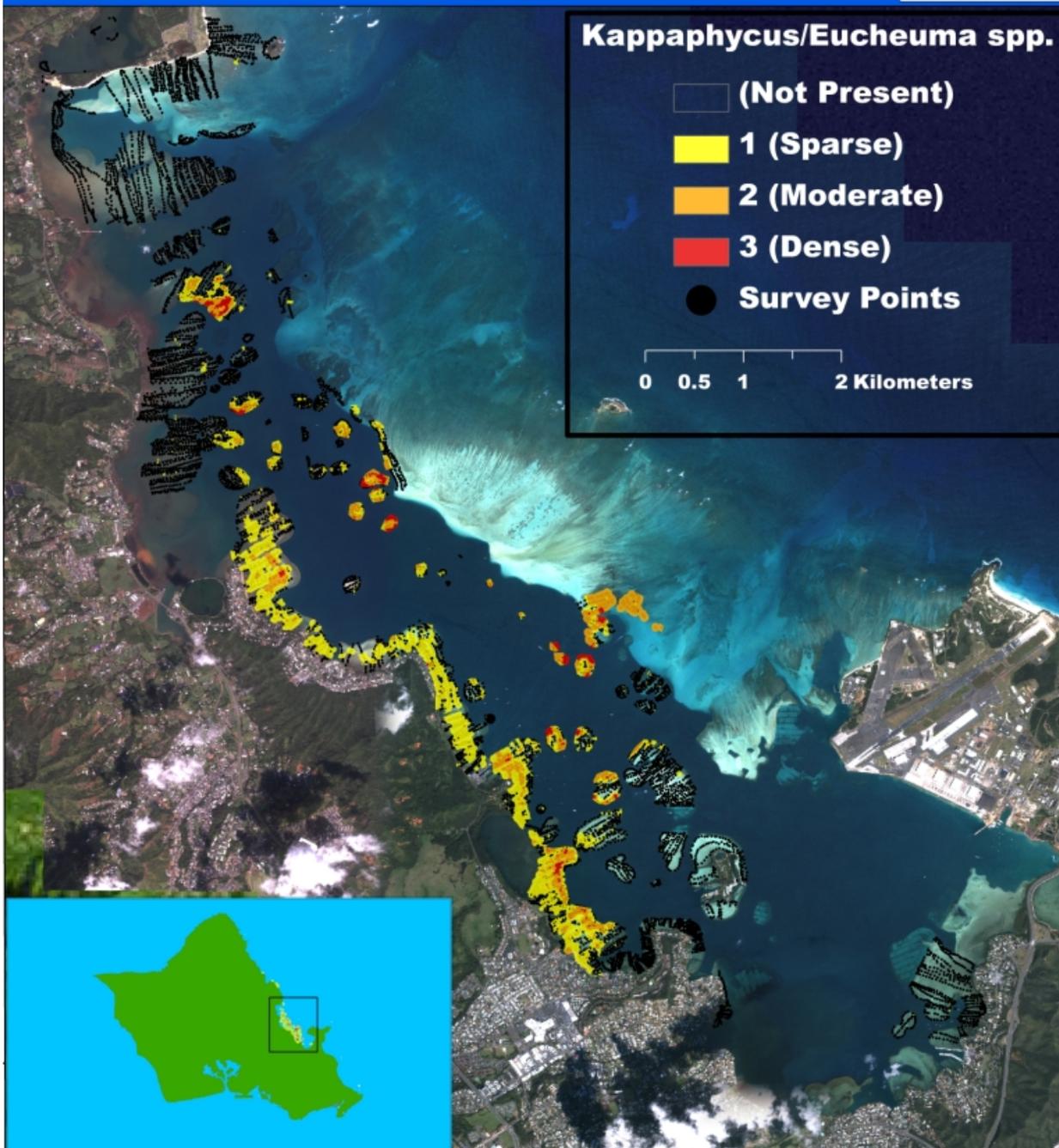
■ 1 (Sparse)

■ 2 (Moderate)

■ 3 (Dense)

● Survey Points

0 0.5 1 2 Kilometers



# Kaneohe Bay 2009, Oahu



## Gracilaria salicornia

□ Not Present

■ 1 (Sparse)

■ 2 (Moderate)

■ 3 (Dense)

● Survey Points

0 0.5 1 2 Kilometers

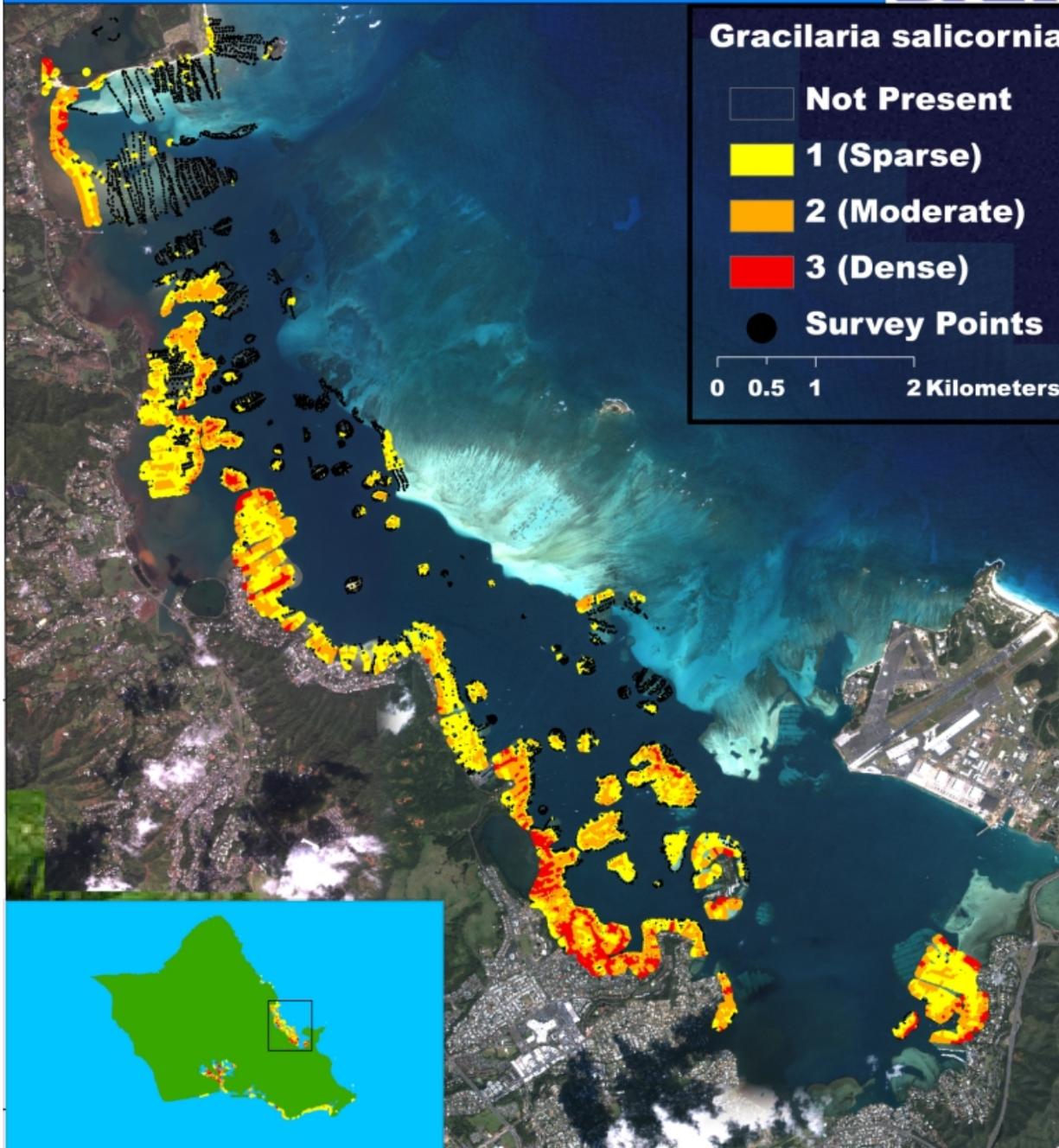
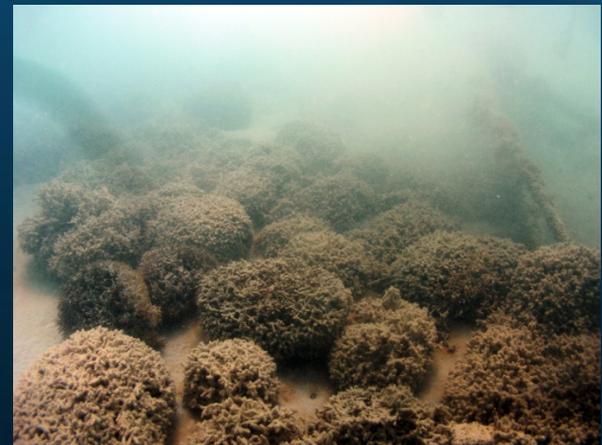


Photo: S. Kaya



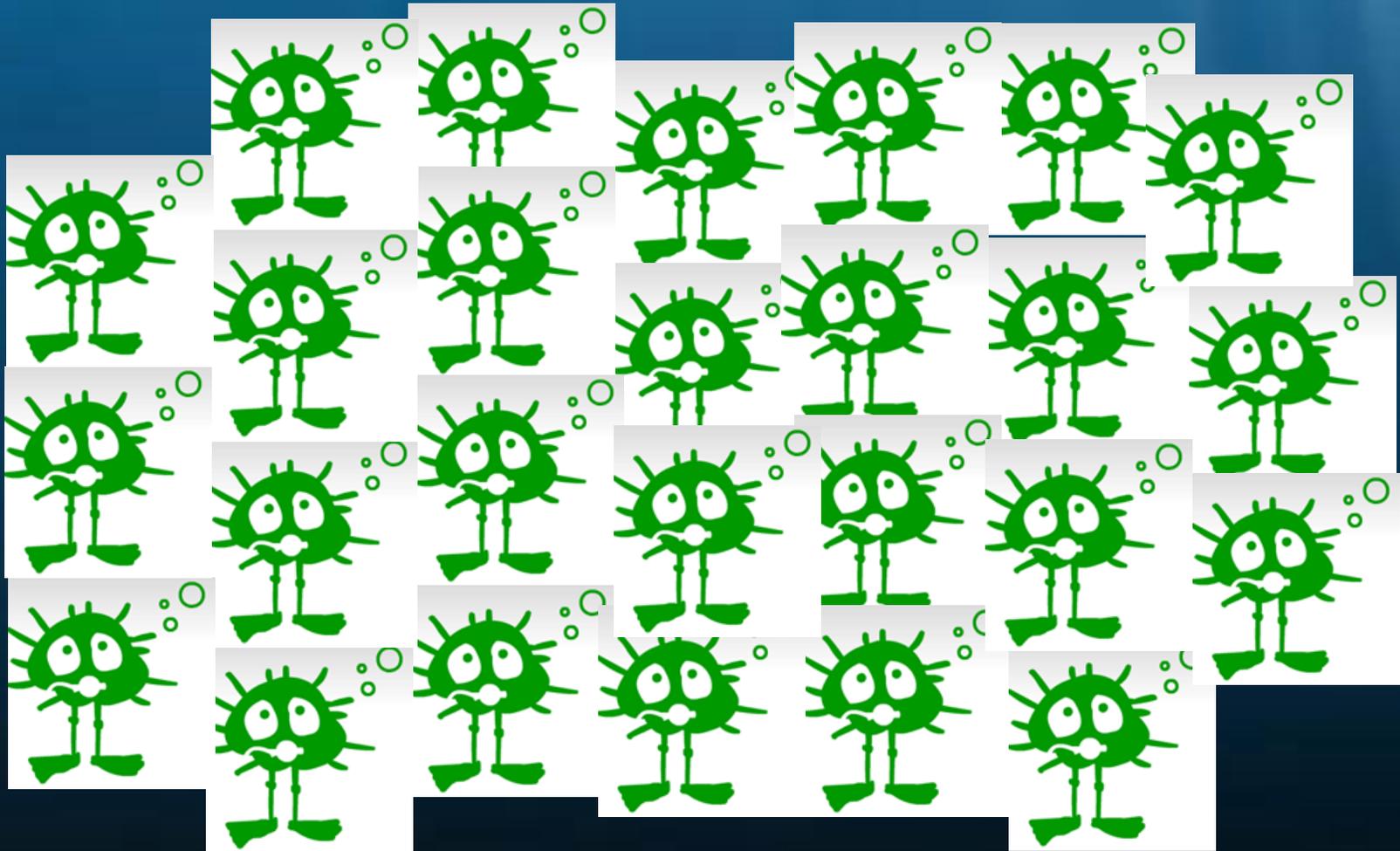
# Supersucker Barges



# Algae Removal



Need an urchin army!



# Urchin Hatchery



Phytoplankton Room

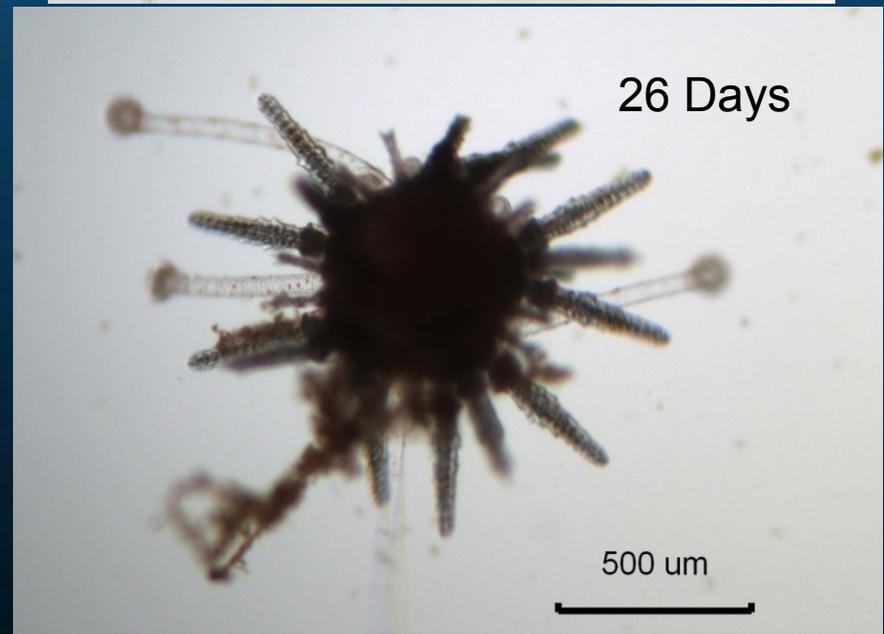
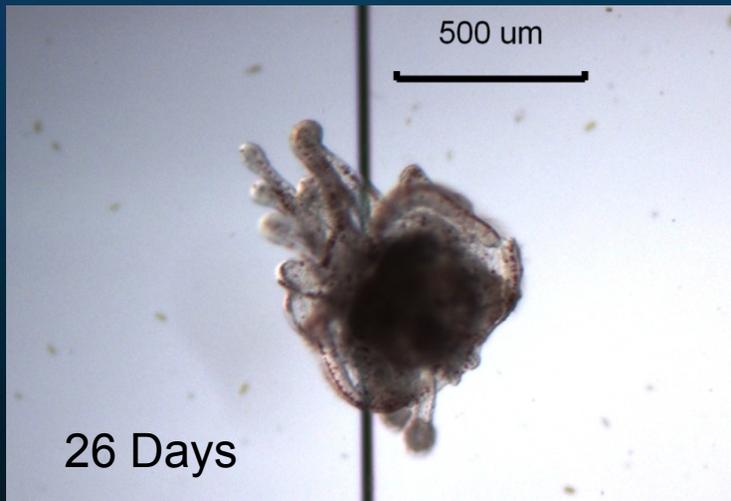
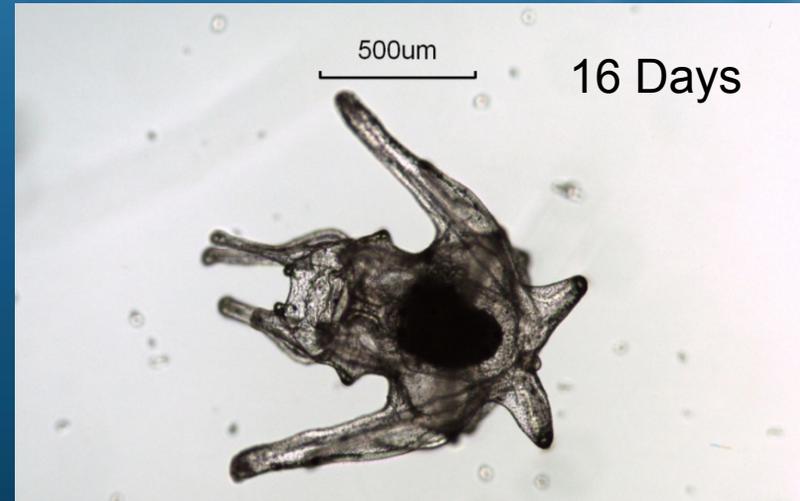


Larval Room

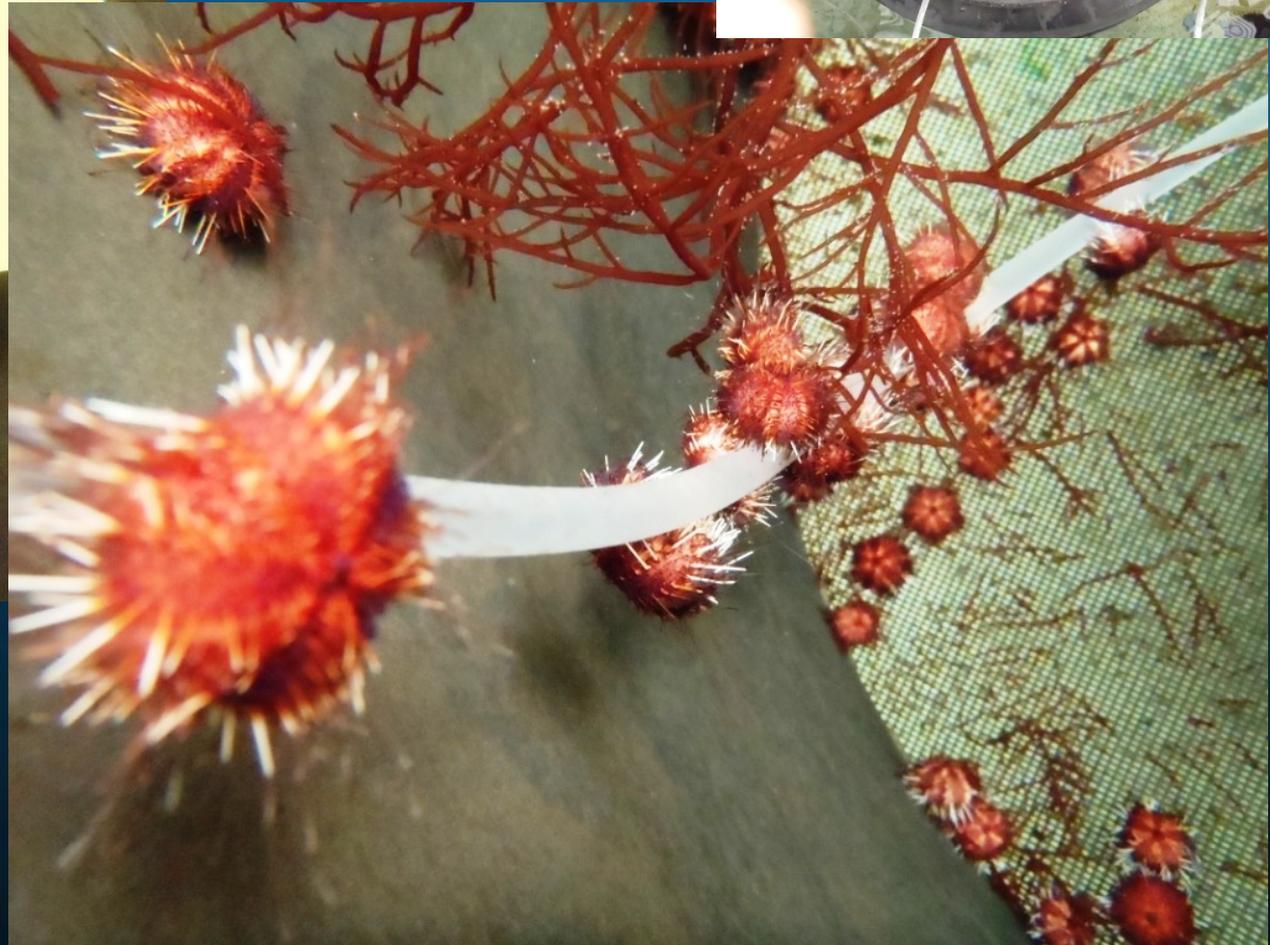


Floating Settlement Tanks

# Larval Development



# *Juvenile Grow-out*



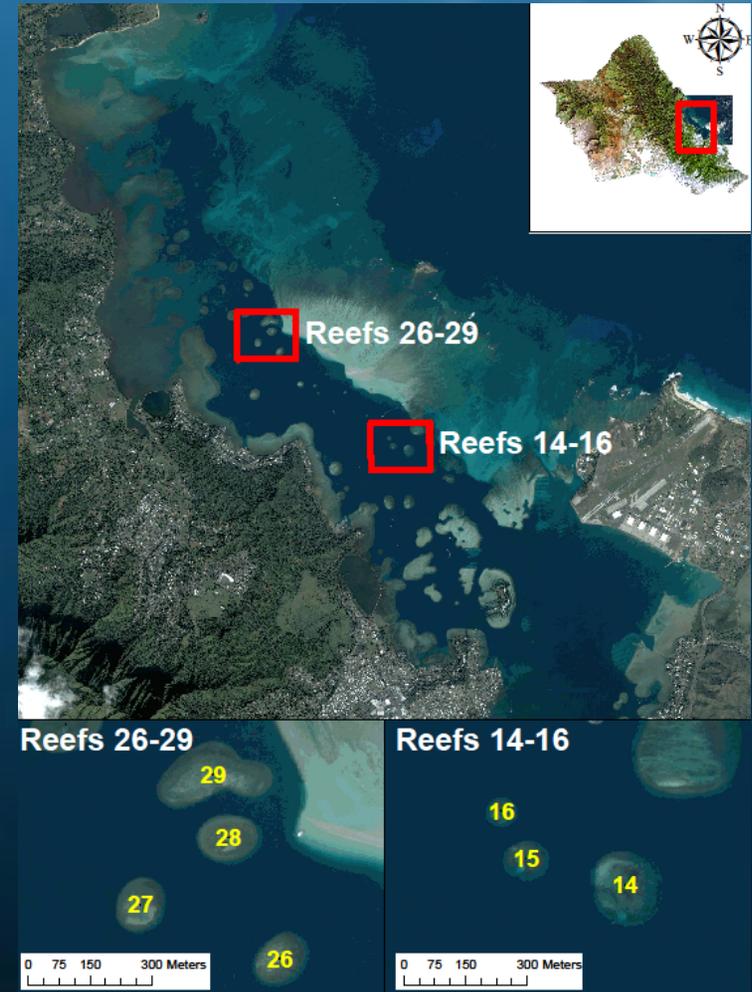
# Current Project

## Reef Restoration

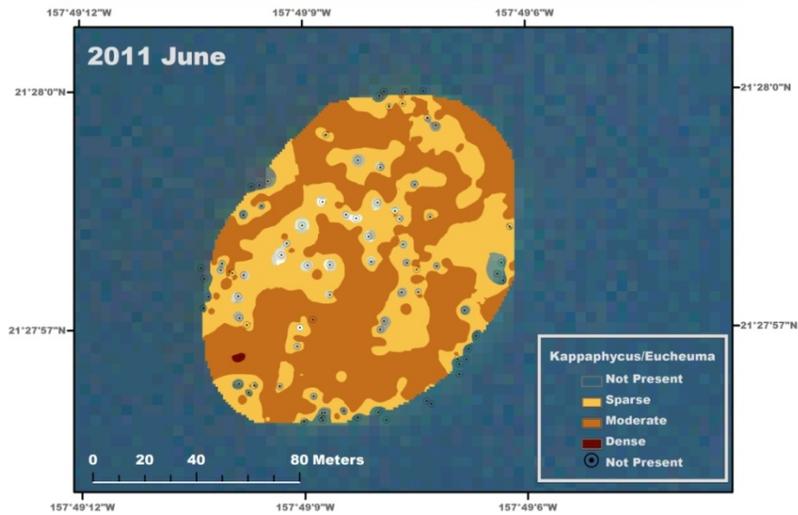
- Removal of algae and addition of urchins to Reefs 26, 27, 29.
- Examine/monitor other variables of urchins and algae growth:
  - Optimal stocking density
  - Monitoring of new coral recruits
  - Any adverse effects with addition of urchins

## Urchin Hatchery

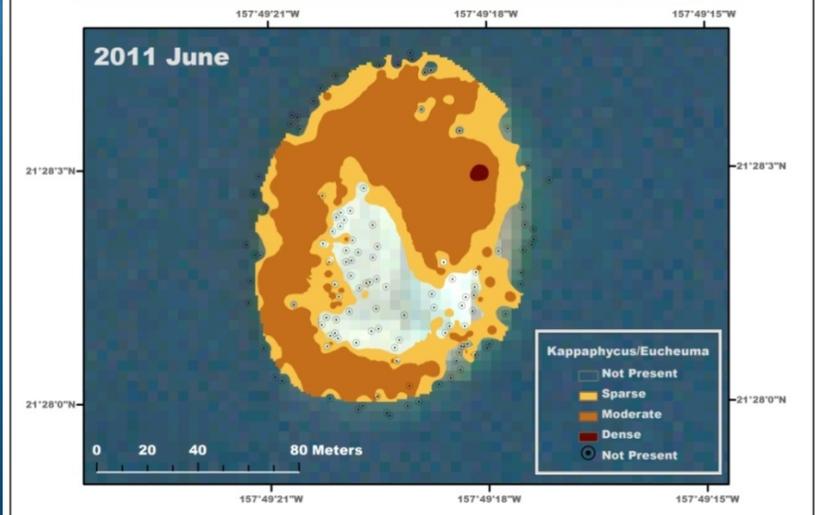
- Post-Settlement Survival
  - Enhance biofilms
    - Isolated Diatom Strains
    - Temporal & Nutrient Enrichment
  - Broodstock Nutrition (?)
- Increase capacity for culturing native seaweeds
- Expand nursery grow-out systems to test spatial requirements of post-larval and juvenile urchins.



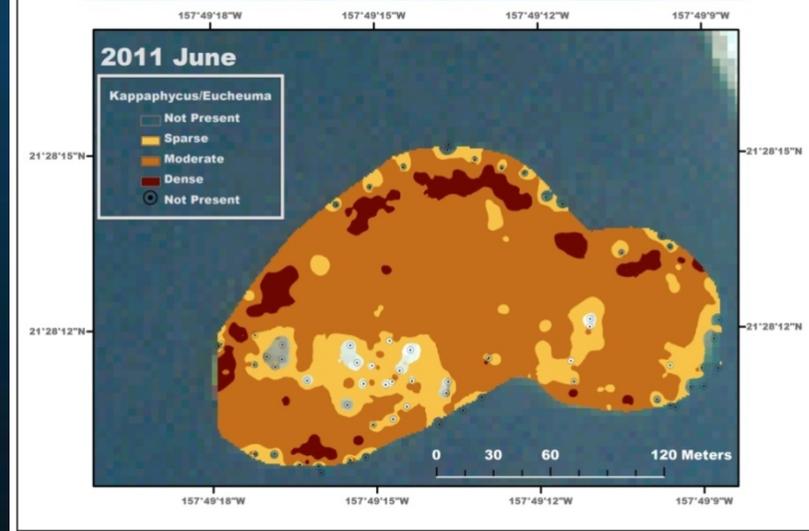
### Reef 26 Kappaphycus Coverage 2011



### Reef 27 Kappaphycus Coverage 2011



### Reef 29 Kappaphycus Coverage 2011



# Patch Reef Summary

## Reef 26 Summary

Date completed: 03/20/12

Days of removal: 23

Pounds Removed: 11,053 lbs

Area Cleared: 12,000 sq. meters

Urchins outplanted: 29,463

## Reef 27 Summary

Date completed: 08/22/12

Days of removal: 25

Pounds Removed: 15,630lbs

Area Cleared: 12,000 sq. meters

Urchins outplanted: 12,550

## Reef 29 Summary

Date completed: Not complete

Days of removal: 26 to date

Pounds Removed: 54,781 lbs

Area Cleared: 10,900 sq. meters

Urchins outplanted: none



# Urchin Density?



# Questions?

